was in Germany, where till lately it was hardly known in its applications. This difference of locality is connected with other points, which are of more importance in an opposite direction. Barrett was in a country in which even obvious improvements upon highly valued arts meet with cold looks and niggard encouragement, when they are not introduced under very influential patronage; he was neglected both by the Royal Society, the Assurance Offices, and the public. Tetens was in a country in which speculation is valued, even in subjects the applications of which are neglected; he occupied honourable and well paid posts in education and in revenue, and died a privy councillor. For all these reasons, I am well satisfied that the important improvement on which I have been writing should, as I am satisfied it will, continue to be called *Barrett's method.*

On the Rates of Mortality prevailing amongst the Male and Female Lives assured in the Eagle Insurance Company during the 44 *years ending* 31 *December,* 1851. *By* CHARLES JELLICOE, *Actuary to that Company.*

[Read before the Institute of Actuaries, 2nd January, 1854, and ordered by the Council to be printed.]

IN discussing the subject of assurance valuations and the most approved methods of making them, I have often had occasion to draw attention to the great importance of ascertaining with the utmost possible accuracy the rates of mortality and interest which have been found to prevail in any case under consideration, so as to determine what rates of premium are really required to provide, independently of other exigencies, for the sums assured, and how far the particular rates charged are sufficient or more than sufficient for that purpose. I have insisted the more strenuously on the necessity of this proceeding, from the conviction that in almost every Association some peculiarity in the prevailing mortality will be found to exist, distinguishing it from that of its neighbour, and arising from the different character of such influences as the condition of life of the persons whose lives are assured, the mode of selection, the greater or less predominance of the male sex and of assurances made by persons on their own lives over such as are effected on the lives of others, the constitution of the Company, and so on. Almost every Association, differing from the rest in

one or more of these characteristics, will be found, as I fully believe, to present peculiar features in its experience; and hence, although we must necessarily be guided at first by such data as older Societies afford, it is, as I have said, of great importance to obtain that of the Association whose affairs we may desire to investigate, so soon as its duration and the number of its members is sufficiently great to afford it with anything like the requisite degree of precision.

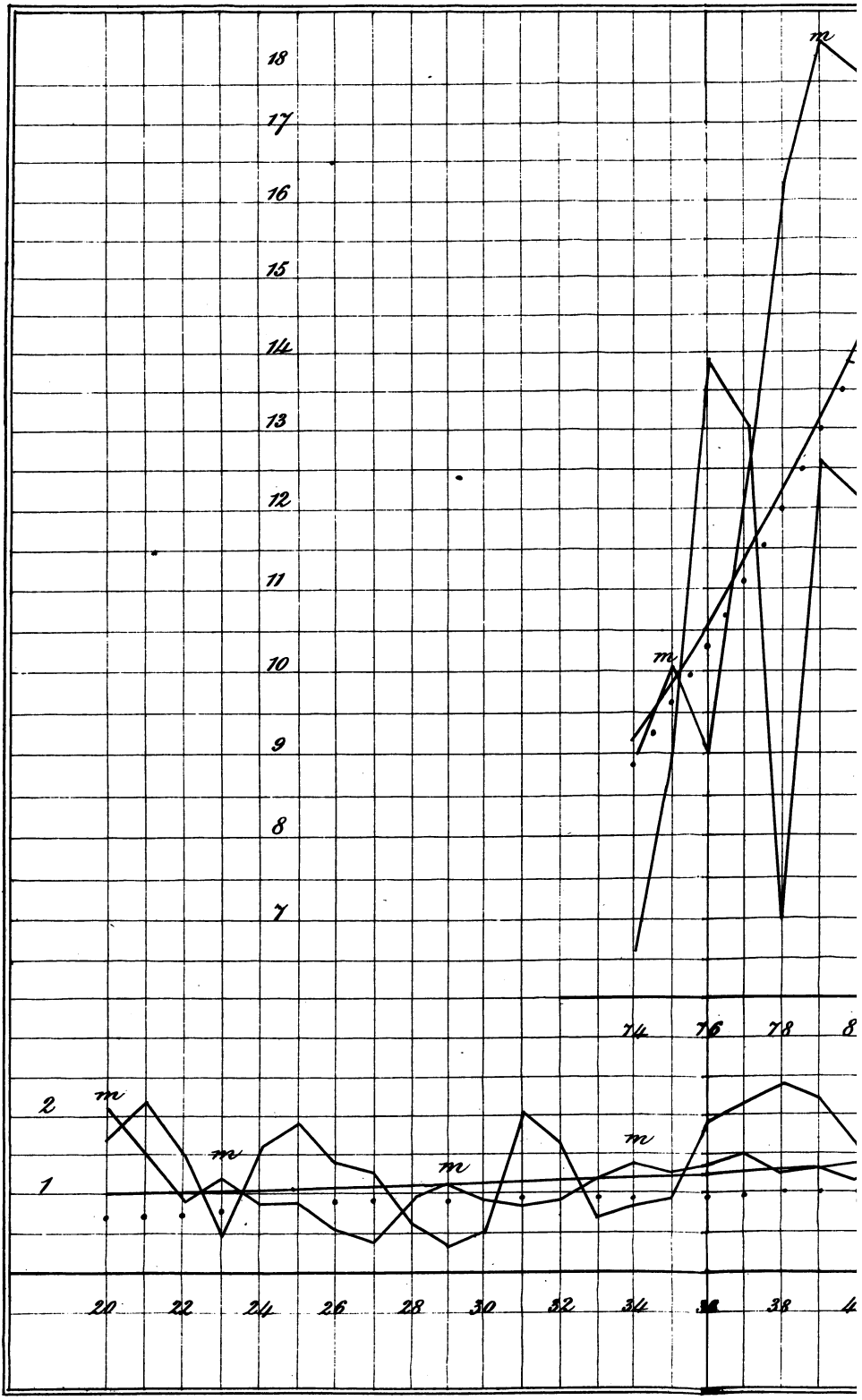
Influenced by considerations of this kind, the directors of the Eagle Insurance Company have caused an investigation to be made into the rates of mortality prevailing in that Office throughout the term of its existence, and have considerately allowed the results now to be made public, believing them to possess some interest for those engaged in similar inquiries. Before making any comment upon these, it will be desirable to state briefly the several processes by which they were elaborated, and the precautions taken to secure as high a degree of accuracy as possible in each and all of them.

As in most other Societies of similar age and character, the instances of several assurances being effected on the same life were found to be numerous; and the first care was therefore to eliminate all duplicate assurances, and to restrict the observation in every case to the first, or at least to one assurance only, on each life.

Notwithstanding what has been said to the contrary, there can be no doubt that the omission of this process, and the enumeration of *policies* in such investigations as if they were *persons*, is likely to lead to conclusions more or less erroneous. In the case under consideration, there can be no doubt that it would have done so.

Having then reduced the registers of the Company to a list of the persons assured in which the name of each individual appeared but once, and which comprised only such as were considered at the time of their entering to be of unimpaired health and constitution, a careful record was made of the age at admission, the number of years continuance, and the age at death or discontinuance, of all the lives, each sex being taken out separately. In this way tables were constructed of the following description; the continuance of each person throughout the year, his death or discontinuance in it, and his existence at the time the observation terminated, being denoted by unity and the letters *d*, *l*, and *e* respectively:*—

* These tables occupy 152 half sheets of "Royal" paper, and comprise, exclusively of other items, upwards of sixty thousand entries in the columns headed with the age.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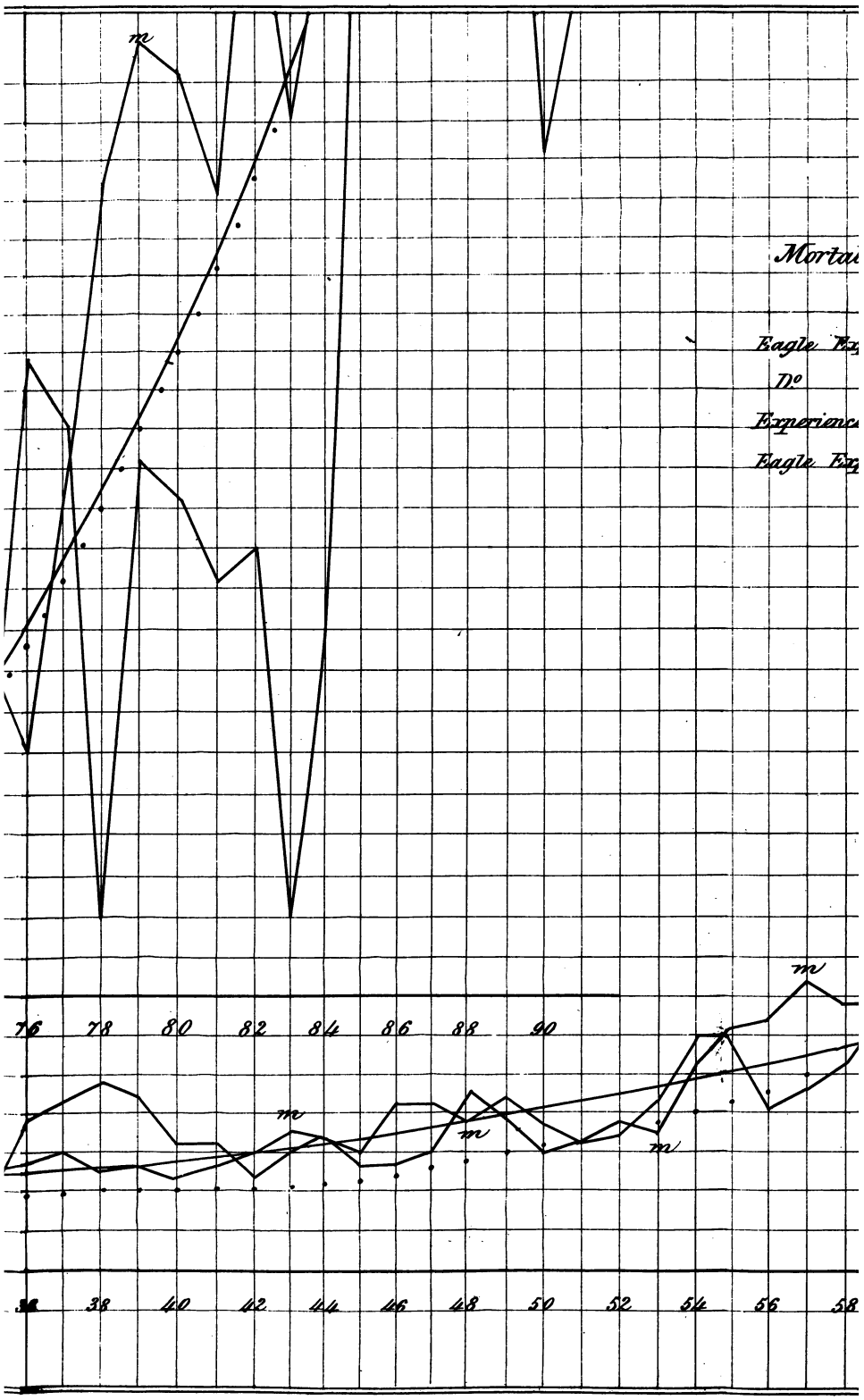
m
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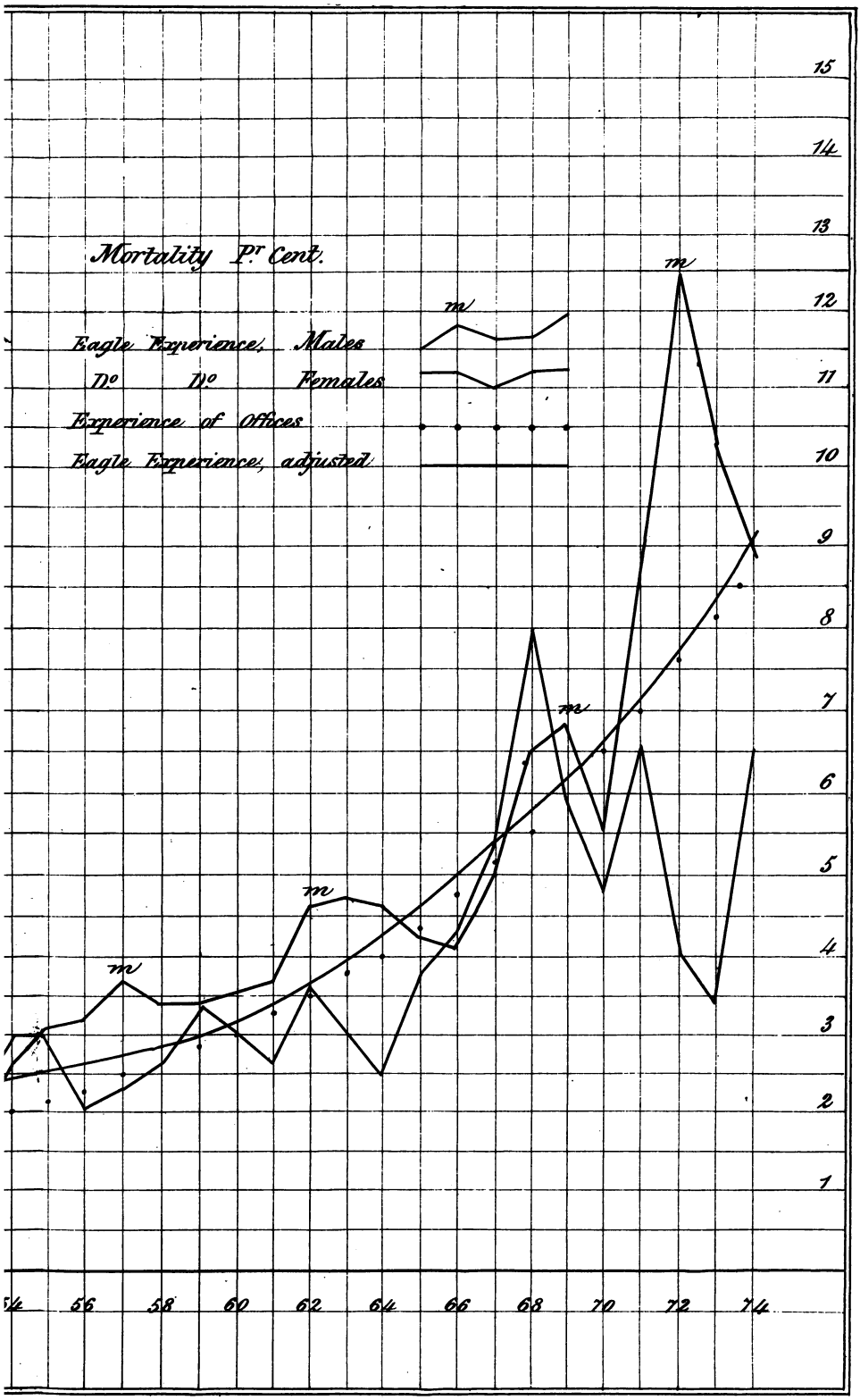
Mortality Pr Cent.
Eagle Experience; Males
Do Do Females
Experience of Offices
Eagle Experience; adjusted
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
54
56
58
60
62
64
66
68
70
72
74

Males.

Number of Policy.	$9\frac{1}{2}$	$10\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	&c.	$91\frac{1}{2}$	$92\frac{1}{2}$	$93\frac{1}{2}$	$94\frac{1}{2}$	$95\frac{1}{2}$	$96\frac{1}{2}$
79,020	1	1	1	1	1	&c.	1	1	*d*			
79,200	1	1	1	*d*	..	&c.						
80,100	..	..	..	1	1	&c.	1	1	1	1	*d*	
81,111	..	..	..	..	..	&c.	1	*e*				
81,120	..	..	..	..	1	&c.						
81,200	..	..	1	1	1	&c.	*d*					
81,300	..	..	..	..	1	&c.	1	1	1	*e*		
81,321	..	..	..	1	1	&c.	1	*e*				
Completed age	2	2	3	4	6	&c.	5	3	2	1		
Lapsed	..	..	..	..	..	&c.						
Existing	..	..	..	..	..	&c.	..	2	..	1		
Died	..	..	..	1	..	&c.	1	..	1	..	1	

It will be seen that the system adopted in this and the following tables is that pursued by Mr. Galloway in his report of the mortality amongst the members of the Amicable Society—that is to say, as regards the time of admission, the *Office age* is in every case assumed to be greater by six months than *the real age;* in other words, age 10 is called $9\frac{1}{2}$; age 11, $10\frac{1}{2}$; and so on. This assumption is not rigidly accurate, since it appears on investigation that the Office age is, on the average, but little more than four months in excess of the real age. The effect of it is therefore to represent the lives as, one with another, two months younger than they really were. This discrepancy I have not, any more than Mr. Galloway, thought it worth while to endeavour to correct; inasmuch as its minuteness renders it very unimportant, and as the effect of it will generally be, in making calculations based upon the table, to bring out results in a very trifling degree (if in any) on the safe side. In this, as in other respects, Mr. Galloway's arrangement appears to me to be the best which has hitherto been devised. As that gentleman observes, "The single assumption introduced is, that the admissions take place, one with another, precisely at the middle of the current year of age; all the rest is matter of calculation." There may be defects, it is true, in this method; but whatever there are are equally to be found in Mr. Morgan's and in Mr. Woolhouse's, whilst these last are wanting in the simplicity which, in this rather material point at least, characterizes Mr. Galloway's.

Having, then, in these two tables a complete record of the

duration, &c. of all the lives under consideration, the next care was to collect the results with a view to arrive at the rates of mortality which they severally indicate. This process will be seen in Tables I., II., and III., which give the usual particulars so often described by writers on this subject. On these particulars it is therefore unnecessary for me to dwell, further than to mention that it has not been thought worth while to avoid fractions in these tables by "doubling"; and that, as regards the usual allowance of half a year's duration made in the case of abandoned and surrendered assurances, the regulations of the Company are such as to give quite sufficient justification of it.

We have here, then, presented the experience as to duration of life of a population consisting of 7,419 individuals—viz., 5,493 males and 1,926 females—selected with more or less care from amongst persons for the most part in the middle and upper ranks of life, and traced from year to year for a period, on the average, of about eight years and a half from the time of their admission; the age of each being, in the great majority of cases, ascertained by certificate or authenticated by formal declaration. As regards the results exhibited when the sexes are distinguished, I have not thought it worth while to tabulate in each case more than the mortality per cent. and the probable mean duration of life—or after-lifetime, as Mr. Farr aptly calls it. These elements afford a good means of comparison, and will enable us sufficiently to judge of the relative vitality of the sexes as between each other, and as contrasted with that which the best authenticated tables exhibit. For greater facility, the following statements give these particulars in decennial groups and at quinquennial epochs.

Annual Mortality per cent., in decennial groups.

Ages.	MALE LIVES.				FEMALE LIVES.			
	Eagle Experience.	Carlisle Table.	Experience of Offices.	Northampton Table.	Eagle Experience.	English Life Table.	Government Annuitants.	Experience of Offices.
20—29	1·03	·76	·77	1·56	1·31	·95	·88	1·68
30—39	1·19	1·05	·92	1·86	1·53	1·14	1·05	1·57
40—49	1·74	1·42	1·23	2·38	1·63	1·34	1·17	1·58
50—59	2·63	1·86	2·14	3·32	2·35	2·06	1·50	2·24
60—69	4·77	4·08	4·36	4·91	4·24	4·05	2·88	3·98
70—79	11·10	8·80	9·42	9·19	8·12	9·16	7·11	11·86
	3·75	3·00	3·14	3·88	3·19	3·11	2·43	3·81

Probable Mean Duration of Life.

Ages.	MALE LIVES.				FEMALE LIVES.			
	Eagle Experience.	Carlisle Table.	Experience of Offices.	Northampton Table.	Eagle Experience.	English Life Table.	Government Annuitants.	Experience of Offices.
20	37·9	41·5	41·5	33·4	37·6	41·	44·0	35·9
25	35·4	37·9	38·0	30·9	35·4	38·	40·8	34·4
30	31·6	34·3	34·4	28·3	32·3	34·	37·6	31·7
35	28·2	31·0	30·9	25·7	29·1	31·	34·3	29·1
40	25·0	27·6	27·3	23·1	26·8	28·	31·1	26·4
45	21·7	24·5	23·7	20·5	23·8	24·	27·8	23·2
50	18·7	21·1	20·2	18·0	20·7	21·	24·4	20·1
55	15·4	17·6	16·9	15·6	17·6	18·	20·8	16·8
60	12·8	14·3	13·8	13·2	14·8	14·	17·3	13·8
65	10·2	11·8	11·0	10·9	11·8	12·	14·0	10·6
70	7·6	9·2	8·5	8·6	9·8	9·	11·0	7·9
75	5·7	7·0	6·5	6·5	7·	7·	8·5	5·4
80	3·9	5·5	4·8	4·8	5·8	5·	6·5	4·8

From these tables it appears that although the rate of mortality amongst the female lives is high comparatively at the earlier ages, it is much the reverse towards the decline of life, and that these aberrations nearly balance each other; so that the expectation in their case is throughout somewhat better than that shown to exist amongst the male portion of the assured. The close resemblance between the experience of the Eagle Company and that of the combined Offices, as regards female lives, is remarkable, and gives confirmation to the accuracy of both; but the rates of mortality at given periods of life differ considerably, notwithstanding. On the whole, the contrast which the data exhibit between the two sexes is consonant with what might be expected from their relative positions. The wear and tear of female life is unquestionably great from twenty to forty, whilst those who outlive this period have for the most part little to disturb the serenity of their declining years. The male sex, on the contrary, though probably possessing more vigour in its prime, is exposed to the labours and anxieties of life to a much later period, and their effect when it approaches is in consequence the more sensibly felt. One inference is, at all events, fully supported by these data—viz., that the insurance of female life at less rates than that of male is scarcely justifiable. A comparison with the expectation of the Carlisle Table or the Experience of Offices will suffice to establish this beyond controversy. The duration of female life may, it is true, be greater than that of male in certain given instances; but until it comes near either of

the standards above mentioned, there is no room for any reduction in favour of the fairer portion of the community.

As might be expected, the blended experience of the Company exhibits features partaking of the character of the mortality prevailing amongst the assured of either sex when taken separately. The following table shows the rate of mortality per cent. and the expectation of life as before; the numbers for each sex being blended, and the results of other tables being added, for the purpose of comparison.

MORTALITY PER CENT.				EXPECTATION OF LIFE.			
Ages.	Eagle Males & Females.	Northampton Table.	Carlisle Table.	Ages.	Eagle Males & Females.	Northampton Table.	Carlisle Table.
20—29	1·10	1·56	·76	20	38·1	33·4	41·5
30—39	1·26	1·86	1·05	30	32·1	28·3	34·3
40—49	1·71	2·38	1·42	40	25·7	23·1	27·6
50—59	2·52	3·32	1·86	50	19·6	18·0	21·1
60—69	4·55	4·91	4·08	60	13·7	13·2	14·3
70—79	9·64	9·19	8·80	70	8·6	8·6	9·2

A slight inspection of these numbers will serve to confirm, so far as the Eagle Insurance Company is concerned, the truth of the observation with which I set out—viz., that every Society would probably be found to have an "experience" more or less peculiar to itself. It will be seen that, although not differing very materially towards the close of life from the Experience of the Offices and from the Northampton Table, the Eagle Experience is at the commencement unlike any other. At that period it appears to occupy a place between the Northampton Table and the Carlisle, and maintains the same position till the later years of life, when it coincides with and ultimately exceeds the rate indicated by the former. Throughout, the influence of the female mortality is perceptible: it serves to exaggerate that amongst the male portion at the earlier ages, and to diminish it at the later ones; bringing it thus into nearer parallelism with the old Northampton Table, although still leaving a considerable margin between them. All these peculiarities, however, will be more readily perceived by means of the diagram which, bearing in mind the often quoted precept as to matters "occulis subjecta fidelibus," I have appended to this paper. In this will be seen the curves expressing the mortality per cent. prevailing amongst the male and female lives when taken separately, and the one denoting the graduated rate found to obtain amongst the whole body when blended together. As this last

represents the general "experience" of the Company, and as it is important to show that the ratios which it indicates have been correctly deduced, I now proceed to that part of the subject; having, I believe, given all the data necessary for such further deductions or comparisons as any one may desire to make.

The Mortality Table—as such an one as that in column 4, page 214, is commonly called—has been formed in the usual way, by means of the ratios which represent from year to year the mortality per cent. Although approximating to the dimensions exhibited by the ordinary run of such tables, it will be found to present irregularities too great to allow of its being properly made the basis of the calculations for which it is needed; and hence we have to seek for the means of moulding it into a due degree of uniformity (such as, were the numbers greater, it would probably assume), without materially changing its character or depriving it of the peculiar features on which its identity depends. Various methods have been proposed and adopted for this purpose: amongst other writers, Mr. Finlaison, Mr. Edmonds, Mr. Davies, and Mr. Gompertz, have, with more or less success, taxed their learning and ingenuity on the subject. Mr. Farren, in his able work on *The Chances of Premature Death,* has not only developed the principles on which the last-named eminent actuary proceeds, but has deduced similar results from independent considerations; and has also shown, with Mr. Farr, the application of the theory of differences to the same end. Mr. Gompertz's method derives a merit from its philosophical character, which, till his time at least, did not belong to any other; for neither the equation proposed by Lambert for the London mortality, and generalized by M. Duvillard,* or the celebrated one of De Moivre,† professed, so far as I am aware, to be other than empirical. It is true, that the theory of exhaustions, ingenious as it is, and practically useful, is not completely borne out by the facts in any given instance; but after a good deal of labour and consideration, I cannot avoid the conclusion that the same result would attend any other theory propounded with the like object. In other words, it appears to

* $L_x = N.\left(\frac{t-x}{t}\right)^2 - m.\left[e^{-\frac{x}{k}} - e^{-\frac{x}{n}}\right]$. *See* Lacroix's *Traité Elémentaire du Calcul des Probabilités*, p. 199.

† $L_x = 86 - x$. The process given by Mr. (now Sir John William) Lubbock, in the paper read by him before the Cambridge Philosophical Society, and printed in their *Transactions*, is one—if I recollect rightly—for the direct determination of the values of annuities by means of equations expressing rates of interest and mortality.

me that no hypothesis will yield such an expression as will enunciate a law of human mortality altogether in accordance with that exhibited by actual data.

Since, then, these curves of mortality which obtain naturally do not appear to be traceable throughout upon any hypothetical principle, we must be content to derive them from the rude elements themselves, by such means as will most truly interpret their nature and character—that is to say, we can only, as it seems, measure the *force* of the mortality by the *rate* of it; and for this last we must always be dependent on the quality of the data before us. Now the rate of the mortality is measured by the ratio of the numbers dying to the numbers living during a given interval; and if we examine any table (such as that in column 3, at page 214) exhibiting these ratios, it becomes obvious that a certain progression exists amongst them, increasing generally as the age increases, notwithstanding the irregularity of those in immediate juxtaposition. We may then fairly presume that this progression has some relation with the age; and what we have to discover is the exact nature of this relation.

For this purpose, let us suppose that the rate in question does increase with the age in a certain progression; it will then follow that a corresponding relation will obtain between successive quantities expressing that rate, taken at equal intervals, let the dimensions of these last be what they may. If, then, we have the relation which exists between equal successive aggregations of such quantities, we can arrive at that subsisting between the quantities themselves. Now this, the formula which Mr. Gompertz has deduced from his hypothesis enables us, I find, very readily to do; for, by a slight modification of it, we can obtain an expression for the rate of mortality at any given interval, in terms of the several aggregate rates comprised in the original table.* This expression it will be convenient to denote by $\Delta.\mathrm{N}$, where

$$\lambda\,\mathrm{N}=\lambda.\frac{m}{1-p}+(x-a)\frac{\lambda p}{n};$$

so that, calling R_x the rate immediately supervening at age x, we shall have $\mathrm{R}_x=\Delta.\mathrm{N}$; or, what is the same thing,

$$\mathrm{R}_x=\Delta.10^{\lambda\frac{m}{1-p}+(x-a)\frac{\lambda p}{n}}.$$

In which equation m represents the aggregate rate of mortality in

* The mode of obtaining this expression I defer till a future occasion, when I propose to examine all the methods that have been devised for the purpose in question.

the first interval n, and p the rate of the progression or relation between the several aggregations in the succeeding intervals.

Having then any unadjusted table, in which the annual rate of mortality per cent., or per unit of life, is given, we have to collect n terms of it successively—in such wise, however, as that, calling the first of them m, the succeeding ones may be as nearly as possible equal to mp, mp^2, mp^3, mp^4, &c.; and then, having found the logarithm of $\frac{m}{1-p}$, and commencing at the origin a, we have merely to add successively the constant $\frac{\lambda p}{n}$, and the differences of the numbers answering to the logarithmic series thus obtained will be the ratios expressing the rate of mortality at every age as required.

But although there would appear to be a tendency in some data to yield the quantities m, mp, mp^2, mp^3, &c., in a constant proportion, it will scarcely ever be found, as I have said, that they exactly obey that order throughout; and hence arises a necessity for certain changes in the values of some of the quantities in the equation above given. Now it is one of the advantages of the method we are discussing, that any incongruity in the curves or series arising under these changes can be detected with the least possible trouble; and thus a long step is gained in the way of finding a remedy for it, since with some little management a remedy can generally be supplied. It will be observed, for instance, that whatever the values of m and p, the rate of mortality at any given age can be ascertained at once; and hence the last term of a series and the first of a following one can be compared with very little labour. If these be inconsistent, another mode of grouping the quantities in the unadjusted table must be resorted to; and it will generally be found, I believe, that a very exact correspondence can be obtained between such series as may be required, with the exercise of a little patience and a moderate degree of dexterity.*

In this way I have readily found that certain specific groupings of the rude ratios in column 3, page 214, would yield incongruous series; whilst, on the other hand, it appears that groups of ten of them together, commencing at age 20, will afford the means of

* The labour required in this adjusting process is not great; but were it otherwise it is well bestowed, for it is in effect a searching out of the law pervading the data; and when this adjustment is once satisfactorily effected, we may be satisfied that the object is attained, and that we have interpreted nature with as much accuracy and fidelity as it is possible, I believe, under all the circumstances to do.

determining the ratios throughout the table, and that, although three different equations are required, the points of junction of the three curves generated by them are barely perceptible. In the first, for instance, $p=1{\cdot}149$ and $m=10{\cdot}996$; the logarithm of $\frac{m}{1-p}$ consequently $=1{\cdot}86804$, and $\frac{\lambda p}{n}={\cdot}00603$. Hence, commencing with the first logarithm, and continually adding the second, we obtain the following series of logarithms and their corresponding natural numbers, and the differences between these last form the table in column 7, page 214, from age 20 to 40. Thus,

1·86804	73·797	1·032	20
1·87407	74·829	1·046	21
1·88010	75·875	1·060	22
1·88613	76·936	1·075	23
1·89216	78·011	1·090	24
1·89819	79·101	&c.	&c.
&c.	&c.		

In the same way the series is continued from 40 to 60, p, however, in this portion being equal to 1·477, and m to 17·078; whilst the remainder of the table is formed by changing the value of those quantities to 2·118 and 45·506 respectively, and proceeding as before. In the new series thus obtained, the sums of the terms from 20 to 29, 30 to 39, &c., are the same as those of the like terms of the original table; and thus the aggregate mortality exhibited by each at those periods is identical, whilst the decennial rate of progression indicated by them is duly imparted in this way to the annual rate. It is perhaps hardly necessary to mention, that the value of p is found by dividing any one group by that which precedes it; and that it should be thus equal to $\frac{m_2}{m_1}$, $\frac{m_3}{m_2}$, $\frac{m_4}{m_3}$, &c., if we denote the successive groups by m_1, m_2, m_3, &c. If each fraction give a different value of p, then such different value will have to be employed throughout the groups indicated by the denominator and numerator of the fraction. If the same value result from each, then one equation will suffice for the whole series.

By such means, then, has the adjusted table in column 8, page 214, been constructed; and in order that the degree of its resemblance to the original one may be judged of, I have given the numbers expressing the mean duration of life, as well as those denoting the mortality per cent. per annum, yielded by both. The

values of m as above given, it will be seen, coincide with the rates of mortality per cent. quoted at page 204, the latter however being one tenth only (as they of course should be) of such values.*

A further evidence as to the degree of identity between the two tables is to be found in the fact of the survivors being frequently the same, or very nearly the same, in number at the same age in each; this it will be observed is the case at ages 30, 40, 50, 60, 65, 70, 73, 80, &c.

Having thus determined, at least as far as is practicable, the true rate of mortality prevailing amongst the persons assured with the Company, it only remains to find the rate of interest actually realized from year to year, and with these elements to construct the tables on which Societies of this description base their ordinary charges. If the profits which are derived from other sources be considered as interest—and they can scarcely be regarded in any other light—there is no doubt that a higher rate of interest than 4 per cent. per annum, on the average, is very commonly obtained. I have however assumed, that the true rate in the present instance is 4 per cent. per annum; and the tables of annuities in column 11, and of annual premiums in column 12, pages 214 and 215, have been calculated at that rate accordingly. Supposing then these elements to be correctly assumed, the annual premiums so derived from them represent truly the payments required to provide for the sums assured merely; and a comparison with those actually charged will serve to show the margin, or contribution made at every age to the general surplus fund. It is this margin or contribution which I have so often insisted that we should endeavour to keep the same for each contributor, after making allowance for the one peculiar charge of commission.

In conclusion, I have only to state that the abstracts have been made and the tables constructed (every item being carefully checked) by two of our members, Mr. Arthur Hutcheson Bailey and Mr. John Lauer Oliver, to whose ability and accuracy in these and similar investigations I with much pleasure take this opportunity to bear testimony.

* The values obtained by the equation are, in fact, those of ordinates to the adjusted curve given in the diagram, the sum total of them being equal, or very nearly equal, to the sum total of the irregular numbers in column 3, pages 214 and 215.

TABLE I.—*Males.*

Age (x).	Completed the Age $x-\frac{1}{2}$.	Existing 31 Dec., 1851, between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Discontinued between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Died between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Number exposed to the risk of Death between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$	Number exposed to the risk of Death between the Ages x and $x+1$.	Number who Died between the Ages x and $x+1$.	Mortality per cent. per Annum.	Mean Duration of Life.	Age (x).
10	29	..	2	..	28·0	58·5	..	0·0000	..	10
11	34	3	4	..	30·5	61·0	..	0·0000	..	11
12	31	..	1	..	30·5	72·0	..	0·0000	..	12
13	43	1	2	..	41·5	87·0	..	0·0000	..	13
14	48	3	2	..	45·5	107·0	1	0·9346	..	14
15	66	5	4	1	61·5	126·0	2	1·5873	..	15
16	70	6	5	1	64·5	136·0	2	1·4706	..	16
17	74	..	5	1	71·5	150·5	1	0·6645	..	17
18	82	3	3	..	79·0	171·5	1	0·5831	..	18
19	99	7	6	1	92·5	201·5	2	0·9926	..	19
20	116	6	8	1	109·0	236·0	5	2·1186	37·91	20
21	151	3	45	4	127·0	323·5	5	1·5456	37·71	21
22	216	5	34	1	196·5	462·0	4	0·8658	37·31	22
23	288	5	40	3	265·5	583·0	7	1·2007	36·62	23
24	344	8	45	4	317·5	716·0	6	0·8380	36·05	24
25	434	14	57	2	398·5	880·0	7	0·7955	35·35	25
26	518	11	62	5	481·5	1014·0	5	0·4931	34·64	26
27	577	18	71	..	532·5	1145·5	5	0·4365	33·81	27
28	661	15	81	5	613·0	1286·5	12	0·9328	32·95	28
29	723	28	71	7	673·5	1418·5	16	1·1280	32·27	29
30	792	23	71	9	745·0	1578·0	14	0·8872	31·63	30
31	891	27	89	5	833·0	1724·0	13	0·7541	30·90	31
32	943	29	75	8	891·0	1865·5	16	0·8577	30·13	32
33	1029	36	73	8	974·5	2027·0	24	1·1840	29·39	33
34	1114	35	88	16	1052·5	2152·0	31	1·4405	28·73	34
35	1160	33	88	15	1099·5	2272·5	29	1·2761	28·15	35
36	1226	36	70	14	1173·0	2379·5	34	1·4289	27·51	36
37	1271	45	84	20	1206·5	2464·5	36	1·4607	26·90	37
38	1321	42	84	16	1258·0	2568·0	34	1·3240	26·29	38
39	1371	48	74	18	1310·0	2634·0	35	1·3288	25·64	39
40	1391	50	84	17	1324·0	2649·5	33	1·2455	24·97	40
41	1387	47	76	16	1325·5	2664·5	35	1·3136	24·29	41
42	1401	55	69	19	1339·0	2686·0	40	1·4892	23·60	42
43	1405	52	64	21	1347·0	2702·0	48	1·7765	22·95	43
44	1407	47	57	27	1355·0	2697·0	45	1·6685	22·35	44
45	1412	62	78	18	1342·0	2654·5	41	1·5446	21·72	45
46	1386	72	75	23	1312·5	2575·5	55	2·1355	21·06	46
47	1324	60	62	32	1263·0	2501·5	53	2·1187	20·51	47
48	1291	48	57	21	1238·5	2456·5	46	1·8725	19·94	48
49	1274	51	61	25	1218·0	2387·5	53	2·2199	19·31	49
50	1227	56	59	28	1169·5	2287·0	42	1·8364	18·74	50

TABLE I.—*Males* (continued).

Age (x).	Completed the Age $x-\frac{1}{2}$.	Existing 31 Dec., 1851, between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Discontinued between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Died between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Number exposed to the risk of Death between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Number exposed to the risk of Death between the Ages x and $x+1$.	Number who Died between the Ages x and $x+1$.	Mortality per cent. per Annum.	Mean Duration of Life.	Age (x).
51	1176	67	50	14	1117·5	2209·5	35	1·5841	18·08	51
52	1138	59	33	21	1092·0	2130·5	39	1·8305	17·36	52
53	1091	72	33	18	1038·5	2034·5	34	1·6712	16·67	53
54	1045	61	37	16	996·0	1935·5	50	2·5833	15·95	54
55	988	59	38	34	939·5	1816·0	57	3·1387	15·36	55
56	917	50	31	23	876·5	1703·0	54	3·1709	14·84	56
57	869	50	35	31	826·5	1600·0	59	3·6875	14·31	57
58	805	35	28	28	773·5	1504·5	51	3·3899	13·85	58
59	767	48	24	23	731·0	1420·5	49	3·4494	13·31	59
60	717	30	25	26	689·5	1324·0	46	3·4743	12·77	60
61	662	40	15	20	634·5	1221·0	45	3·6855	12·21	61
62	616	40	19	25	586·5	1109·0	51	4·5988	11·66	62
63	558	53	18	26	522·5	981·5	46	4·6865	11·19	63
64	481	35	9	20	459·0	867·0	40	4·6136	10·72	64
65	429	32	10	20	408·0	767·0	33	4·3025	10·21	65
66	376	27	7	13	359·0	688·0	28	4·0698	9·65	66
67	338	12	6	15	329·0	621·5	31	4·9880	9·04	67
68	309	31	2	16	292·5	552·0	36	6·5218	8·49	68
69	272	15	10	20	259·5	487·5	33	6·7693	8·05	69
70	234	11	1	13	228·0	430·5	24	5·5750	7·59	70
71	209	11	2	11	202·5	381·5	33	8·6500	7·01	71
72	187	9	7	22	179·0	323·5	40	12·3648	6·63	72
73	151	11	2	18	144·5	261·5	27	10·3251	6·49	73
74	123	10	2	9	117·0	211·5	19	8·7834	6·18	74
75	103	12	5	10	94·5	168·5	17	10·0890	5·73	75
76	77	6	..	7	74·0	134·0	12	8·9552	5·32	76
77	64	8	..	5	60·0	108·0	13	12·0371	4·79	77
78	50	3	1	8	48·0	86·5	14	16·1850	4·38	78
79	40	2	1	6	38·5	66·5	12	18·0451	4·13	79
80	31	5	1	6	28·0	45·5	8	17·5824	3·93	80
81	19	3	..	2	17·5	31·0	5	16·1290	3·66	81
82	14	1	..	3	13·5	23·5	5	21·2765	3·26	82
83	10	..	..	2	10·0	17·5	3	17·1429	3·01	83
84	8	..	1	1	7·5	14·5	5	34·4830	2·53	84
85	7	..	..	4	7·0	10·0	4	40·0000	..	85
86	3	..	..	..	3·0	6·0	..	00·0000	..	86
87	3	..	..	..	3·0	6·0	2	33·3333	..	87
88	3	..	..	2	3·0	4·0	2	50·0000	..	88
89	1	..	..	..	1·0	2·0	..	00·0000	..	89
90	1	..	..	..	1·0	2·0	1	50·0000	..	90
91	1	..	..	1	1·0	1·0	1	100·0000	..	91

TABLE II.—*Females.*

Age x.	Completed the Age $x-\frac{1}{2}$.	Existing 31 Dec., 1851, between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Discontinued between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Died between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Number exposed to the risk of Death between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Number exposed to the risk of Death between the Ages x and $x+1$.	Number who Died between the Ages x and $x+1$.	Mortality per cent. per Annum.	Mean Duration of Life.	Age x.
10	40	1	..	..	39·5	91·0	..	0·0000	..	10
11	53	1	2	..	51·5	109·0	1	0·9174	..	11
12	60	2	3	1	57·5	113·0	2	1·7699	..	12
13	59	4	3	1	55·5	114·5	2	1·7467	..	13
14	62	2	4	1	59·0	117·5	2	1·7021	..	14
15	60	1	2	1	58·5	116·5	1	0·8584	..	15
16	61	4	2	..	58·0	119·0	..	0·0000	..	16
17	64	5	1	..	61·0	126·5	..	0·0000	..	17
18	69	4	3	..	65·5	140·0	1	0·7143	..	18
19	78	1	6	1	74·5	159·0	2	1·3579	..	19
20	87	2	3	1	84·5	175·0	3	1·7143	37·62	20
21	107	4	29	2	90·5	182·5	4	2·1918	37·27	21
22	95	3	3	2	92·0	203·0	3	1·4778	37·09	22
23	114	2	4	1	111·0	233·5	1	0·4283	36·64	23
24	127	3	6	..	122·5	249·5	4	1·6032	35·80	24
25	137	6	14	4	127·0	257·5	5	1·9418	35·37	25
26	136	4	7	1	130·5	277·5	4	1·4414	35·06	26
27	154	4	10	3	147·0	306·5	4	1·3050	34·57	27
28	165	7	4	1	159·5	325·0	2	0·6154	34·02	28
29	175	6	13	1	165·5	348·0	1	0·2874	33·22	29
30	190	4	11	..	182·5	376·0	2	0·5319	32·32	30
31	203	6	13	2	193·5	401·0	8	1·9950	31·49	31
32	217	5	14	6	207·5	422·5	7	1·6568	31·11	32
33	223	7	9	1	215·0	449·0	3	0·6682	30·62	33
34	243	6	12	2	234·0	488·5	4	0·8188	29·82	34
35	265	8	13	2	254·5	527·5	5	0·9479	29·07	35
36	288	17	13	3	273·0	565·5	11	1·9451	28·34	36
37	302	9	10	8	292·5	609·0	13	2·1346	27·89	37
38	324	7	8	5	316·5	661·5	16	2·4187	27·49	38
39	356	10	12	11	345·0	717·0	16	2·2315	27·16	39
40	387	8	22	5	372·0	762·0	13	1·7060	26·77	40
41	403	9	17	8	390·0	803·0	14	1·7434	26·22	41
42	430	17	17	6	413·0	835·5	10	1·1969	25·68	42
43	437	15	14	4	422·5	856·5	13	1·5178	24·98	43
44	449	18	12	9	434·0	887·5	15	1·6901	24·36	44
45	468	15	14	6	453·5	924·0	13	1·4069	23·77	45
46	490	17	22	7	470·5	960·5	13	1·3534	23·10	46
47	504	17	11	6	490·0	992·0	15	1·5122	22·41	47
48	519	20	14	9	502·0	1018·5	23	2·2581	21·75	48
49	536	27	12	14	516·5	1035·0	20	1·9324	21·24	49
50	536	15	20	6	518·5	1035·5	16	1·5451	20·65	50
51	539	22	22	10	517·0	1032·0	17	1·6473	19·96	51
52	535	21	19	7	515·0	1036·0	18	1·7375	19·29	52

TABLE II.—*Females* (continued).

Age x.	Completed the Age $x-\frac{1}{2}$.	Existing 31 Dec., 1851, between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Discontinued between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Died between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Number exposed to the risk of Death between the Ages $x-\frac{1}{2}$ and $x+\frac{1}{2}$.	Number exposed to the risk of Death between the Ages x and $x+1$.	Number who Died between the Ages x and $x+1$.	Mortality per cent. per Annum.	Mean Duration of Life.	Age x.
53	542	23	19	11	521·0	1041·5	23	2·2083	18·62	53
54	535	16	13	12	520·5	1046·0	31	2·9637	18·03	54
55	542	17	16	19	525·5	1051·0	31	2·9495	17·57	55
56	538	16	9	12	525·5	1033·5	21	2·0320	17·09	56
57	527	24	14	9	508·0	1013·0	23	2·2704	16·43	57
58	524	27	11	14	505·0	992·5	27	2·7204	15·80	58
59	505	28	7	13	487·5	961·0	33	3·4339	15·23	59
60	494	31	10	20	473·5	915·5	29	3·1677	14·75	60
61	457	23	7	9	442·0	853·5	23	2·6948	14·22	61
62	429	24	11	14	411·5	792·5	29	3·6593	13·60	62
63	394	22	4	15	381·0	727·5	22	3·0240	13·10	63
64	365	31	6	7	346·5	668·0	17	2·5449	12·49	64
65	333	18	5	10	321·5	623·5	24	3·8492	11·80	65
66	312	14	6	14	302·0	577·0	25	4·3328	11·25	66
67	288	19	7	11	275·0	524·5	28	5·3384	10·74	67
68	261	19	4	17	249·5	469·0	37	7·8891	10·32	68
69	228	17	..	20	219·5	404·5	24	5·9332	10·16	69
70	194	17	1	4	185·0	353·0	17	4·8159	9·77	70
71	175	12	2	13	168·0	312·5	21	6·7200	9·24	71
72	151	12	1	8	144·5	267·5	11	4·1121	8·87	72
73	130	14	..	3	123·0	235·0	8	3·4042	8·23	73
74	118	10	2	5	112·0	208·0	14	6·7307	7·50	74
75	101	9	1	9	96·0	178·0	16	8·9888	7·00	75
76	83	2	..	7	82·0	152·5	21	13·7705	6·65	76
77	74	7	..	14	70·5	122·5	16	13·0612	6·63	77
78	53	2	..	2	52·0	99·5	7	7·0350	6·55	78
79	49	3	..	5	47·5	87·5	11	12·5719	6·01	79
80	41	2	..	6	40·0	73·5	9	12·2449	5·80	80
81	34	1	..	3	33·5	62·5	7	11·2000	5·54	81
82	30	2	..	4	29·0	52·0	6	11·5386	5·17	82
83	24	2	..	2	23·0	43·0	3	6·9767	4·78	83
84	20	..	..	1	20·0	38·0	4	10·5263	4·10	84
85	19	2	..	3	18·0	31·0	6	19·3549	3·53	85
86	14	2	..	3	13·0	22·0	5	22·7273	3·25	86
87	9	..	..	2	9·0	16·0	4	25·0000	3·06	87
88	7	..	..	2	7·0	12·0	4	33·3333	..	88
89	5	..	..	2	5·0	8·0	2	25·0000	..	89
90	3	..	..	..	3·0	6·0	1	16·6667	..	90
91	3	..	..	1	3·0	5·0	1	20·0000	..	91
92	2	..	..	..	2·0	4·0	..	00·0000	..	92
93	2	..	..	..	2·0	4·0	2	50·0000	..	93
94	2	..	..	2	2·0	2·0	2	100·0000	..	94

TABLE III.—*Males and Females.*

Age.	UNADJUSTED RESULTS.						ADJUSTED RESULTS.						Age.
	Number exposed to risk of Death.	Number of Deaths.	Mortality per cent. per Annum.	Number who complete the Age opposite.	Number who Die in their next Year.	Mean Duration of Life.	Mortality per cent. per Annum.	Number who complete the Age opposite.	Number who Die in their next Year.	Mean Duration of Life.	Value of Annuity at Age opposite.	Annual Premium to assure £100.	
	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	
10	149·5	0	000	..	..	..	..	..	..	..	..	..	10
11	170·0	1	0·588	..	..	..	..	..	..	..	..	..	11
12	185·0	2	1·081	..	..	..	..	..	..	..	..	..	12
13	201·5	2	0·993	..	..	..	..	..	..	..	..	..	13
14	224·5	3	1·336	..	..	..	..	..	..	..	..	..	14
15	242·5	3	1·237	..	..	..	..	..	..	..	..	..	15
16	255·0	2	0·784	..	..	..	..	..	..	..	..	..	16
17	277·0	1	0·361	..	..	..	..	..	..	..	..	..	17
18	311·5	2	0·642	..	..	..	..	..	..	..	..	..	18
19	360·5	4	1·110	..	..	..	..	..	..	..	..	..	19
20	411·0	8	1·946	9215	179	38·11	1·032	9215	95	37·99	17·410	1·586	20
21	506·0	9	1·779	9036	161	37·86	1·046	9120	95	37·39	17·295	1·619	21
22	665·0	7	1·053	8875	93	37·53	1·060	9025	96	36·77	17·176	1·655	22
23	816·5	8	0·980	8782	87	36·92	1·075	8929	96	36·16	17·055	1·692	23
24	965·5	10	1·036	8695	90	36·29	1·090	8823	96	35·59	16·951	1·725	24
25	1137·5	12	1·055	8605	90	35·66	1·106	8727	97	34·98	16·823	1·765	25
26	1291·5	9	0·697	8515	60	35·03	1·122	8630	97	34·37	16·692	1·806	26
27	1452·0	9	0·620	8455	52	34·28	1·137	8533	97	33·75	16·557	1·850	27
28	1611·5	14	0·869	8403	73	33·49	1·153	8436	97	33·13	16·417	1·896	28
29	1766·5	17	0·962	8330	80	32·78	1·169	8339	97	32·51	16·273	1·943	29
30	1954·0	16	0·819	8250	68	32·10	1·186	8242	98	31·89	16·123	1·994	30
31	2125·0	21	0·988	8182	81	31·36	1·201	8144	98	31·27	15·970	2·047	31
32	2288·0	23	1·006	8101	81	30·67	1·218	8046	98	30·64	15·811	2·103	32
33	2476·0	27	1·090	8020	88	29·97	1·235	7948	98	30·01	15·646	2·161	33
34	2640·5	35	1·325	7932	105	29·31	1·254	7850	98	29·38	15·475	2·223	34
35	2800·0	34	1·214	7827	95	28·69	1·271	7752	99	28·75	15·297	2·290	35
36	2945·0	45	1·529	7732	118	28·04	1·288	7653	99	28·11	15·115	2·359	36
37	3073·5	49	1·594	7614	121	27·47	1·306	7554	99	27·48	14·925	2·433	37
38	3229·5	50	1·548	7493	116	26·90	1·325	7455	99	26·83	14·729	2·511	38
39	3351·0	51	1·523	7377	113	26·32	1·365	7356	100	26·19	14·524	2·595	39
40	3411·5	46	1·349	7264	98	25·72	1·422	7256	103	25·54	14·313	2·685	40
41	3467·5	49	1·414	7166	101	25·08	1·481	7153	106	24·90	14·100	2·776	41
42	3521·5	50	1·420	7065	100	24·43	1·540	7047	109	24·27	13·884	2·872	42
43	3558·5	61	1·714	6965	120	23·77	1·601	6938	111	23·64	13·667	2·971	43
44	3584·5	60	1·674	6845	114	23·18	1·664	6827	114	23·02	13·444	3·077	44
45	3578·5	54	1·509	6731	102	22·56	1·731	6713	116	22·40	13·220	3·186	45
46	3536·0	68	1·923	6629	127	21·90	1·799	6597	119	21·79	12·990	3·302	46
47	3493·5	68	1·946	6502	127	21·32	1·872	6478	121	21·18	12·758	3·423	47
48	3475·0	69	1·986	6375	126	20·73	1·945	6357	124	20·57	12·521	3·549	48
49	3422·5	73	2·133	6249	133	20·14	2·023	6233	126	19·97	12·281	3·683	49
50	3322·5	58	1·746	6116	107	19·57	2·104	6107	128	19·37	12·035	3·825	50
51	3241·5	52	1·604	6009	97	18·92	2·188	5979	131	18·78	11·785	3·976	51
52	3166·5	57	1·800	5912	106	18·21	2·274	5848	133	18·18	11·531	4·134	52
53	3076·0	57	1·853	5806	108	17·54	2·364	5715	135	17·60	11·271	4·303	53
54	2981·5	81	2·717	5698	154	16·86	2·459	5580	137	17·01	11·005	4·483	54

TABLE III.—*Males and Females* (continued).

Age.	UNADJUSTED RESULTS.						ADJUSTED RESULTS.						Age.
	Number exposed to risk of Death.	Number of Deaths.	Mortality per cent. per Annum.	Number who complete the Age opposite.	Number who Die in their next Year.	Mean Duration of Life	Mortality per cent. per Annum.	Number who complete the Age opposite.	Number who Die in their next Year.	Mean Duration of Life.	Value of Annuity at Age opposite.	Annual Premium to assure £100.	
	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10.)	(11.)	(12.)	
55	2867·0	83	3·069	5544	170	16·31	2·556	5443	139	16·43	10·734	4·676	55
56	2736·5	75	2·741	5374	148	15·81	2·659	5304	141	15·84	10·456	4·882	56
57	2613·0	82	3·138	5226	164	15·24	2·763	5163	143	15·26	10·171	5·105	57
58	2497·0	78	3·124	5062	158	14·72	2·874	5020	144	14·68	9·879	5·345	58
59	2381·5	82	3·443	4904	169	14·18	3·000	4876	146	14·10	9·577	5·609	59
60	2239·5	75	3·349	4735	158	13·66	3·172	4730	150	13·52	9·268	5·892	60
61	2074·5	68	3·278	4577	150	13·12	3·419	4580	157	12·95	8·954	6·200	61
62	1901·5	80	4·207	4427	187	12·55	3·686	4423	163	12·39	8·643	6·524	62
63	1709·0	68	3·980	4240	168	12·08	3·973	4260	169	11·84	8·333	6·869	63
64	1535·0	57	3·714	4072	152	11·56	4·282	4091	175	11·31	8·024	7·235	64
65	1390·5	57	4·100	3920	160	10·98	4·616	3916	181	10·80	7·718	7·625	65
66	1265·0	53	4·190	3760	158	10·43	4·976	3735	186	10·30	7·416	8·036	66
67	1146·0	59	5·148	3602	185	9·86	5·364	3549	190	9·81	7·116	8·475	67
68	1021·0	73	7·150	3417	245	9·37	5·781	3359	194	9·34	6·820	8·942	68
69	892·0	57	6·390	3172	202	9·06	6·232	3165	197	8·88	6·527	9·439	69
70	783·5	41	5·232	2970	156	8·64	6·718	2968	199	8·43	6·239	9·968	70
71	694·0	54	7·780	2814	219	8·10	7·241	2769	200	8·00	5·955	10·531	71
72	591·0	51	8·630	2595	224	7·74	7·807	2569	200	7·59	5·675	11·134	72
73	496·5	35	7·050	2371	167	7·42	8·415	2369	199	7·19	5·400	11·779	73
74	419·5	33	7·866	2204	173	6·95	9·068	2170	197	6·80	5·131	12·464	74
75	346·5	33	9·524	2031	194	6·50	9·776	1973	193	6·43	4·870	13·190	75
76	286·5	33	11·516	1837	211	6·13	10·538	1780	188	6·07	4·613	13·970	76
77	230·5	29	12·584	1626	205	5·86	11·360	1592	181	5·73	4·365	14·793	77
78	186·0	21	11·291	1421	160	5·63	12·244	1411	173	5·40	4·121	15·681	78
79	154·0	23	14·935	1261	189	5·28	13·199	1238	163	5·08	3·885	16·624	79
80	119·0	17	14·286	1072	153	5·12	14·230	1075	153	4·78	3·653	17·645	80
81	93·5	12	12·834	919	118	4·89	15·330	922	141	4·49	3·430	..	81
82	75·5	11	14·570	801	117	4·54	16·530	781	129	4·21	3·211	..	82
83	60·5	6	9·917	684	67	4·23	17·820	652	116	3·94	3·001	..	83
84	52·5	9	17·142	617	106	3·64	19·210	536	103	3·68	2·796	..	84
85	41·0	10	24·390	511	125	3·29	20·710	433	90	3·44	2·599	..	85
86	28·0	5	17·857	386	69	3·19	22·320	343	77	3·21	2·413	..	86
87	22·0	6	27·273	317	86	2·77	24·060	266	64	3·00	2·236	..	87
88	16·0	6	37·500	231	87	2·62	25·930	202	52	2·79	2·062	..	88
89	10·0	2	20·000	144	29	2·91	27·950	150	42	2·59	1·888	..	89
90	8·0	2	25·000	115	28	2·51	30·130	108	33	2·40	1·726	..	90
91	6·0	2	33·333	87	29	2·17	32·500	75	24	2·23	1·585	..	91
92	4·0	0	..	58	0	2·00	35·010	51	18	2·05	1·425	..	92
93	4·0	2	..	58	29	1·00	37·741	33	12	1·89	1·290	..	93
94	2·0	2	..	29	..	..	40·680	21	9	1·69	1·108	..	94
95	..	..	..	..	..	..	43·851	12	5	1·58	1·017	..	95
96	..	..	..	..	..	..	47·268	7	3	1·36	·814	..	96
97	..	..	..	..	..	..	50·951	4	2	1·00	·481	..	97
98	..	..	..	..	..	..	..	2	2	·50	..	..	98